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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/988,387	11/19/2001	Paul Van Der Veen	P 284021 P-0217.010-US	8241

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EXAMINER	
JOHNSTON, PHILLIP A	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 05/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/988,387	VAN DER VEEN, PAUL	
	Examiner	Art Unit	
	Phillip A. Johnston	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 February 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

1. This Office Action is submitted in response to amendment dated 2-25-2005, wherein claims 1, and 3-14 are pending.

Claims Rejection – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, and 3-12, and 14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,369,398 to Gelernt, in view of Kleinschmidt, U.S. Patent No. 6,160,832.

Gelernt (398) discloses a lithographic system and method used in the fabrication of integrated circuits, having a source of radiation 110 that exposes a resist 160, that has been coated on the substrate surface 180, and a mask 130, positioned between the light source 110 and the substrate 180; as well as a lens component 120 used to collimate the light, or radiation, to illuminate the mask 130, as recited in claims 1 and 11,12, and 14. See Column 1, line 30-47.

Gelernt (398) fails to teach the use of an acoustic sensor in detection and control of light source intensity. However, Kleinschmidt (832) discloses a lithography source calibration apparatus and method that, instead of using the optogalvanic effect to measure the light absorption through the gas of the module using, e.g., a photodiode or photomultiplier tube, a microphone for photoacoustic detection may be used. See Column 10, line 59-65.

Kleinschmidt (832) also discloses a main control unit 4 communicates electronically with a motor drive 6 for a line-narrowing and tuning block 5, as well as with a display 8. The main control unit 4 is either a standard PC or an especially designed microprocessor unit for controlling the laser system.

The system further includes a signal processing and driving source 3 for the wavelength calibration module 2. The signal processing and driving source 3 provides an electrical supply for the wavelength calibration module 2. The signal processing and driving source further detects changes in current through the galvatron when irradiated with narrow bandwidth radiation matching a transition line of the gaseous element 21, as recited in claims 1,3,4, and 9. See Column 7, line 26-42.

Therefore it would have been obvious to one of ordinary skill in the art that Gelernt's (398) lithographic exposure system can be modified to use the acoustic detection apparatus and method in accordance with Kleinschmidt (832), to monitor and control the intensity of light traversing the chamber, thereby minimizing the intensity attenuation due to air absorption, and improving production cycle time, which is an objective of both the Gelernt (398) and Kleinschmidt (832) inventions.

4. Claims 5-10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gelernt (398) and Kleinschmidt (832) in view of Yamaguchi, U.S. Patent No. 5,333,495.

The combination of Gelernt (398) and Kleinschmidt (832) discloses nearly all the limitations of claims 5-10 and 13, but fails to disclose the detection of vibration in an object and use it to control beam intensity of a lithography apparatus. However, Yamaguchi (495) discloses a method and apparatus for detection of surface acoustic waves in semiconductor wafers due to the well-known photo-acoustic effect. See Column 4, line 15-34.

It is also implied herein that those of ordinary skill in the art of lithography light sources such as Gelernt (398) and Kleinschmidt (832), would be motivated to utilize the well-known method of ellipsoidal focusing to direct sound generated by the beam to the detector, as recited in claims 9 and 10. See for example Melnychuk, U.S. Patent No. 6,586,757

Therefore it would have been obvious to one of ordinary skill in the art that the lithographic exposure system of Gelernt (398) and Kleinschmidt (832) can be modified to use the detection of surface waves in accordance with Yamaguchi (495), to provide a photoacoustic signal for detecting vibrations in a semiconductor wafer caused by the incident light source, thereby controlling the laser system.

Examiners Response to Arguments

5. Applicant's arguments filed 2-25-2005 have been fully considered but they are not persuasive.

Arguments 1 and 2.

Applicant states that "Consequently, neither Gelernt nor Kleinschmidt, alone or in combination, disclose, teach or suggest, inter-alia, "an acoustic sensor constructed and arranged to detect sounds caused by the passage of pulses of radiation of the projection beam; and a controller in communication with said acoustic sensor and responsive to an output signal of said acoustic sensor, wherein said controller is configured to control a radiation energy per unit area delivered by said projection beam of radiation to said substrate in response to said output signal of said acoustic system" as recited in claim 1 and, inter-alia, "detecting one of: sounds caused by the passage of pulses of radiation of said projection beam; vibrations in an object on which said projection beam is incident, and sounds emitted by an object on which said projection beam is incident and controlling, responsive to the detecting, the radiation energy per unit area delivered by said projection beam to said substrate during an exposure of a target portion," as recited in claim 13."

The applicant also states, " Applicant respectfully submits that none of Gelernt, Kleinschmidt and Yamaguchi, taken alone or in combination, disclose, teach or suggest the subject matter recited in claims 5 and 13."

The applicant is respectfully directed to applicants specification paragraph (0014), which states; In a known lithographic apparatus, dose control is done by

monitoring the projection bean intensity at a point in the radiation system and calibrating the absorption of radiation of the projection beam that occurs between that point and substrate level. Monitoring the projection beam intensity is performed using a partially transmissive mirror in the radiation system to divert a known fraction of the projection beam energy to an energy sensor. The energy sensor measures the radiation energy in the known fraction of the projection beam and so enables the projection beam energy at a given point in the radiation system to be determined. The calibration of said absorption of radiation is done by replacing the substrate by a supplementary energy sensor for a series of calibration runs. The output of the former energy sensor effectively measures variations in the output of the radiation source and is combined with the calibration results of said absorption to predict the energy level at substrate level. In some cases the prediction of the energy level at substrate level may take account of, for example, settings of components for shaping a cross section of the projection beam of radiation. Parameters affecting the dose, e.g. duration of the exposure or scanning speed, and/or the output of the radiation source can then be adjusted to deliver the desired dose to the resist.

The applicant is also respectfully directed to Kleinschmidt (832), Column 1, line 55-67 and Column 2, line 1-13, which states;

The examiner has interpreted from the applicant's and Kleinschmidt (832) references above, that it is known in the art to perform lithography source calibration to determine the amount of absorption that occurs between the light source and the substrate; and that a method of laser light source calibration and control, using various

detection devices including an acoustic detector, is clearly performed by Kleinschmidt (832) to minimize the intensity (energy per unit area) attenuation due to air absorption during lithography.

The applicant is also respectfully directed to Gelernt (398), Column 5, line 27-44; and Column 7 line 48-63, which state; This difference in absorption coefficients has a direct bearing on the vacuum requirement for a lithographic tool, and a significant relaxation of the vacuum or inert atmosphere requirement can be realized by performing lithography at the wavelength of approximately 121.6 nm.

This advantage can best be understood by considering the transmitted intensity of an incident radiation beam in an absorbing medium. In general, the intensity of a transmitted beam of radiation, I_t, is related to the absorption coefficient of a medium by:

$$\ln(I_t / I_o) = - \epsilon n x, \qquad \text{Equation (1)}$$

where I_o is the incident beam intensity, ϵ is an absorption coefficient of the medium in $atm^{-1}\ cm^{-1}$, n is the pressure of the absorbing medium in atm, and x is the path length of the absorbing medium in cm.

It should be noted that the practice of the present invention does not depend on the choice of specific operating pressure, temperature, path length, or the propagation medium. Rather, the invention entails a method of performing lithography at irradiating wavelengths λ corresponding to regions of low air absorption. As such, even if the propagation medium is predominantly nitrogen, such as that achieved by nitrogen

purging of a stepper, the invention can be practiced as long as the irradiating wavelength λ satisfies the condition of low air (or oxygen) absorption. For example, the irradiating wavelength λ may be determined by examining its corresponding absorption coefficient of O_2 (e.g., from FIG. 2c), which would give rise to a desirable % transmission of the exposure radiation according to Equation (1).

The examiner has interpreted from the Gelernt (398) references above that the Gelernt (398) invention is designed to optimize the VUV intensity of a lithography source, by minimizing air absorption through selection of an incident laser wavelength based on that laser wavelength's Oxygen absorption properties, and would be motivated to calibrate the selected laser light source in accordance with the calibration and control means of Kleinschmidt (832) to maximize its wavelength dependent intensity (% transmission) in the lithography system, particularly since the calibration of laser source absorption is well known to one of ordinary skill in the art of lithography.

Conclusion

6. The Amendment filed on 2-25-2005 under 37 CFR 1.131 has been considered but is ineffective to overcome the Gelernt (398), Kleinschmidt (832), and Yamaguchi (495) references.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 6:30 am to 3:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (571) 272-2477. The fax phone number for the organization where the application or proceeding is assigned is 703 872 9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PJ
May 4, 2005

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